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BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

INSECT LOSS SURVEY

BLACK'S MOUNTAIN EXPERIMENTAL FOREST

Season 1938

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Forest Insect Laboratory
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INSECT LOSS SURVEY

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Introduction

A cruise of all trees killed since the 100 percent green cruise was made on the Black's Mountain Experimental Forest (2) in 1933 and 1934 was completed by the California Forest and Range Experiment Station during the season of 1937. This cruise completed the loss records of all tree species for the years 1933-1936 inclusive. The responsibility for conducting the yearly loss cruise was then given over to the Bureau of Entomology and Plant Quarantine.

During the spring of 1938, a crew of four men, consisting of J. W. Bongberg, crew leader, L. M. Thorpe, R. D. McCulley and E. M. Black, worked intermittently for a period of eight weeks to make an intensive insect loss survey of the entire Experimental Forest. The total 1937 insect loss inventory for all tree species was completed during this period. In addition, during the fall of 1938, approximately 900 acres were cruised to sample the 1938 infestation.

Loss History, 1933-1936 Inclusive

Insect losses in pine and fir species present on the Experimental Forest have been exceptionally high since the green cruise of 1933-1934. The peak of an epidemic western pine beetle infestation occurred in ponderosa pine during this period. The fir engraver beetle has accounted for an exceptionally high yearly loss in white fir. Losses in Jeffrey pine have been proportionally high. The Experiment Station's summary of the loss records has shown an average yearly pine loss of 203.4 B.M. per acre (2). This loss figure was obtained by segregating compartments into groups according to the period of time having elapsed between the original green cruise in 1933-1934 and the insect loss cruise in 1937. A few trees killed during 1937 are included in this average loss figure.

A summary of the loss records, omitting the partial 1937 loss mentioned above, for all tree species during this period is given in table 1.

Table 1.

Insect Losses on the Black's Mountain Experimental Forest. 1933-1936 incl.
9134.7 timbered acres

Tree Species	Number of Trees	Total B.M. volume	Trees Per acre	Volume per acre
P. Pine	4,798	5,262,095	0.53	576
J. Pine	362	502,176	0.04	55
W. Fir	4,346	4,073,013	0.48	446
I. Cedar	112	109,240	0.01	12
Total	9,618	9,946,524	1.05	1,089

(Weighted pine loss - 203.4 B.M. per acre per year.)

Elements of Loss Other Than Insect Caused

There are various factors other than insects that contribute to the gross drain on an area. High winds, lightning, fungus, fire injuries, and logging damage all contribute to the seasonal loss record. Despite the fact that insects often occupy trees weakened by the above agencies, it is possible to consider that the trees' death primarily has been the result of accidental injuries. For this reason, the total yearly loss is segregated according to the agencies believed to be responsible for the trees' death. Because of the possibility of small infestation centers becoming established as a result of contagion from the overflow of beetles attracted to weakened trees, and that accidental deaths may distort the true picture of insect activities, the above mentioned factors should be briefly discussed.

Lightning. From studies conducted in the ponderosa and Jeffrey pine stands in the Lassen National Forest, California, Hopping (3) states "if there is epidemic infestation within the area every lightning struck tree becomes infested. If, however, the infestation is very slight, lightning struck trees often escape being attacked. --- beetles prefer and select trees struck by lightning." It is entirely probable that if a lightning struck tree escapes being attacked by insects, the weakening effect of the lightning strike is gradually overcome. For that reason, if healing of the lightning scar is in evidence when the tree becomes infested by insects, accident will be eliminated as the cause of death. During 1937, the pine loss as a result of lightning strikes amounted to 9 trees, a total of 25,704 B.M.

Fungus. In general, fungi attacking ponderosa and Jeffrey pine do not weaken the tree to the point where barkbeetles are immediately attracted to the weakened tree. However, during 1938, a single ponderosa pine was found killed as a result of fungus attacks. In this case, conduction was stopped by a complete infestation of roots and sapwood of the lower 10 feet of bole which resulted in the death of the tree.

Fire Injuries. The role of fire as a factor in weakening trees and resulting in subsequent death, with reference to conditions found on the Experimental Forest, pertains chiefly to injuries of the root crowns resulting from the burning of slash. The red turpentine beetle frequently attacks trees previously injured by fire, and inflicts further injury on the trees. The combined weakening effects of fire and turpentine beetles often result in the trees' death. One tree, 308 B.M., in the 1937 seasonal loss died as a direct result of fire injury and subsequent attacks by the red turpentine beetle.

Logging Damage. The basal injuries to trees as a result of logging often has an effect similar to that caused by slash fire. The combined effects of this mechanical injury and the work of the red turpentine beetle may result in trees being killed by subsequent barkbeetle attack.

Wind-thrown Trees. At times, wind-thrown trees constitute a fairly high percentage of the total drain on an area. This type of loss will be recorded, but will be considered as accidental and not a part of the loss due to insects. Experience has shown, however, that wind-throws may affect an infestation trend to a considerable degree. A complete inventory of wind-thrown trees for the years 1937 and 1938 was not made during the loss cruise of 1938. Such an inventory will be made during 1939.

In this report, accidental death which can be attributed to one or more of the above agencies has not been considered a part of the loss caused by insects.

Insect Loss History, Season of 1937 and 1938

Since the Black's Mountain Experiment deals primarily with pine, the discussion of insect loss, for the most part, will be limited to the two pine species, i.e., ponderosa and Jeffrey pine. Loss records for white fir and incense cedar appear only in the tables. The chief points of difference in infestation conditions during 1937 and 1938 are as follows:

1. The 1937 infestation was found to be in an endemic state. Infested trees were found scattered over the entire area. Trees of the overmature and decadent type made up the majority of the loss.

2. During 1938 there was a definite tendency for the infestation to occur in small groups. This grouping tendency, entirely absent in 1937, seems significant.

3. By using the 900 acres sampled during the fall of 1938 to represent conditions on the entire area, the total 1938 seasonal loss is expected to be somewhat greater than that found in 1937.

Despite climatic conditions somewhat more favorable to tree vigor during the past two seasons, insect populations have increased in this area. The first evidence of grouping tendencies was noticed during the summer of 1938. In part, this group loss seemed to start, or be associated with, the infestation of a currently decadent type of tree. The overflow of beetles attracted to the "key" tree is believed to be responsible for the infestation of the other nearby, and presumable more resistant, trees in these small groups. Insect losses for the cacut area and for the season of 1937 and 1938 are shown in table 2.

Table 2.

	Insect Loss, 1937 8891.7 timbered acres				Insect Loss, 1938 (Partial) 892.6 timbered acres			
Tree Species	No. of Trees	Total BM volume	Trees per A.	Volume per A.	No. of Trees	Total BM volume	Trees per A.	Volume per A.
P. Pine	352	454,610	.04	51	36	46,387	.04	52
J. Pine	64	125,628	.01	14	2	2,928	.002	3
F. Fir	148	139,006	.02	15	12	15,691	.01	18
I. Cedar	1	316	-	-	1	464	-	-
Total	580	719,554	.07	81	53	67,470	.06	76

Pine loss - 65 BM per acre Cruised pine loss - 57 BM per A.

Distribution of Insect Loss Within Risk Groups

During 1937, risk ratings (1) were given to approximately 16,000 trees on 750 acres. This acreage has since remained undisturbed by logging operations. Trees that have died as a result of insect attack since the ratings were applied can be grouped according to the risk ratings given them in 1937. The trees placed in risk groups 3 and 4 were judged to be the ones most likely to die. The trees in risk groups 1 and 2 were appraised as resistant individuals. The distribution of the total insect loss since the risk ratings were applied and the 1937 green stand are given in table 3. The ratio of loss to occurrence in stand, by risk groups, is shown in figure 1.

Table 3.

Distribution of Insect Loss Within Risk Groups

Risk Groups	1937 Stand % of Total Trees	1937 Stand % of Total Volume	Insect Loss % of Total Trees	Insect Loss % of Total Volume	Ratio Trees	Ratio Volume
1	70.4	59.1	7.0	1.3	.10	.02
2	18.8	25.7	8.5	7.3	.45	.28
3	5.9	8.4	11.3	10.7	1.92	1.27
4	4.8	6.8	73.2	80.7	15.32	11.91
Low Risk (1 and 2)	89.2	84.8	15.5	8.6	.17	.10
High Risk (3 and 4)	10.7	15.2	84.5	91.4	7.90	6.01

Of the total number of trees classified during 1937, 13,915 were rated as low risk. 1672 trees were rated as high risk. The total loss since marking shows that only .09% of the low risk trees have died while 4.79% of the high risk trees have succumbed. So far, and for only this relatively short period of observation, the mortality rate in high risk trees has been nearly 45 times that in low risk trees.

Loss Reduction through Sanitation-Salvage Cutting

Logging operations for the removal of high risk trees during the season of 1937 were limited to three compartments, namely: 02-14, 06-10 and 08-10, a total of 243 acres. An area adjacent to the cutting, compartment 02-12, was left untreated. For a four year period prior to logging, the average yearly insect loss on each of the two areas being compared was found to be the same, i.e., 1.07% of the total green volume. Therefore, conditions on the two areas can be considered comparable. A comparison of subsequent loss records on the cut and uncut compartments should show the reduction of loss secured by the removal of the high risk trees. Table 4.

Table 4

Area	Insect Loss % of stand Trees	Insect Loss % of stand Volume	Loss Reduction Trees	Loss Reduction BM Volume
Untreated	.53	.74		
Treated	.14	.10	73.6%	86.5%

In percent of stand, there have been 4 times as many trees and over 7 times as much volume killed on the untreated area as on the treated compartments during the 14 month period following the sanitation-salvage cut in 1937.

Summary

An intensive insect loss cruise on the Black's Mountain Experimental Forest was made during the spring of 1938 to (1) record the total loss of the previous year, (2) to determine, in areas previously classified as to risk, the mortality in each of the four risk groups, and (3) to find out what reduction in loss was secured by an application of a sanitation-salvage cut in which high risk trees were removed from the stands. These points may be summarized as follows:

1. During the four year period previous to 1937, pine losses on the Experimental Forest have averaged 203 BM per acre per year.

2. Losses during 1937 and 1938 were found to be considerably lower than this previous four year average. During 1937, the pine loss amounted to an average of 67 BM per acre. The completed 1938 record will probably show some increase over the 1937 figure.

3. During the first year of observation since risk ratings were applied, pine losses have occurred predominately in the trees previously classed as high risks.

4. The removal of high risk trees in a sanitation-salvage cut has brought about a substantial decrease of insect activities on these cut areas during the first year of observation.

Plans for 1939

An intensive cruise covering the entire Experimental Forest will be made during the spring of 1939 to record the total 1938 loss. All wind-thrown trees for the years 1937 and 1938 will be recorded and their location mapped. The losses on areas where trees have previously been rated as to risk will definitely show the type of trees making up the greater portion of the seasonal loss.

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2. Dunning, D. "A Sustained Yield Experiment in Ponderosa Pine in Northeastern California". Mimeographed Report. Berkeley, California 1938.

3. Hopping, Ralph "Relation Between Abnormality and Insect Attacks in Western Yellow and Jeffrey Pine Stands". Jour. Forestry. Vol. 23. 1925.

Figure 2. Lightning struck tree on Creggerr[illegible] 06-10 infested with brood of the [illegible] beetle. The death of this tree is considered to be accidental. (Photo #101758 - [illegible] 1938)

Figure 3. Group of trees on Compartment 1 killed during 1938 by the Western Pine Beetle. The tree on the left, previously rated as high risk, was the first tree to become infested. An overflow of beetles attracted to the "key" tree attacked and killed the other low risk trees in this group. (Photo - V. A. Salman. 1938.)

Figure 4. A staining fungus apparently responsible for the death of this tree. Picture shows the heavily stained sapwood in the basal 10 feet of bole. This tree had previously been rated as low risk. (Photo #101668 - F.A.Selman. 1938.)